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(54) NONWOVEN FABRIC FOR WET TOWEL HAVING  
ANTIMICROBIAL PROPERTY AND METHOD FOR PRODUCING  
THE SAME

**(57)Abstract:**

**PROBLEM TO BE SOLVED:** To obtain a disposable nonwoven fabric for wet towels having a high mildewproof property without skin irritation nor an unpleasant smell, and to provide a method for producing the nonwoven fabric.

**SOLUTION:** An aqueous dispersion comprising a surfactant, a thickener and a fixing agent and an antimicrobial agent composed of 2-(thiazolyl) benzimidazole and 2-pyridinethiol oxide zinc salt having 0.7-1.5  $\mu\text{m}$  particle diameter is sprayed on one or both surfaces of a dry nonwoven fabric or a wet nonwoven fabric and to uniformly apply the antimicrobial agent thereto.

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whole quantity, and solid content concentration being 1 - 15 % of the weight / according to claim 3 ].

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] Fungus resistance and \*\*\*\*\* of this invention are high, and it does not have stimulative [ over the skin ], and relates to the nonwoven fabric for steamed towels without an odor, and its manufacturing method.

[0002]

[Description of the Prior Art] The present condition is grade or cutting for about one week - six months until the disposable steamed towel used at a teahouse, a restaurant, etc. is actually used from the manufacture. In the meantime, since a disposable steamed towel is maintained at a damp or wet condition, it is common that sterilization processing is performed at the time of manufacture. The approach of carrying out the spray of the water solution of a germicide to the front face of a dry type nonwoven fabric or a wet nonwoven fabric is usually adopted as this sterilization processing, and the cation system germicide represented with the chlorine-based germicide represented with a sodium hypochlorite, a stabilization chlorine dioxide, etc., a benzalkonium chloride, cetylpyridinium chloride, etc. as a germicide has been used chiefly. However, in order to have expected the durable bactericidal effect from the disposable steamed towel with the chlorine-based germicide, the quite high-concentration germicide water solution had to be sprayed on the nonwoven fabric, and there was un-arranging [ for which a strong chlorine smell adheres to a disposable steamed towel as the result ]. Moreover, when a cation system germicide was used, about [ that uniform antibacterial effectiveness is not acquired ] and the drugs concerned had the fault which spoils the feeling of use as a disposable steamed towel in order to give a

feeling of slime to nonwoven fabric fiber.

[0003]

[Problem(s) to be Solved by the Invention] As for the disposable steamed towel which is in a damp or wet condition for a long period of time until practical use is presented, it is desirable that neither mold nor bacteria is generated in the meantime, and not breeding is desirable. When practical use is presented not only with it but with a disposable steamed towel, it is desirable for there to be neither displeasure nor skin irritation and not to be accompanied by the odor at all. An unpleasant smell originates in propagation of various kinds of bacteria in many cases. However, it was difficult to realize these requests with the above-mentioned conventional technique. This invention cancels the trouble of the conventional technique, is excellent in antibacterial effectiveness, especially antifungal, and aims at the thing which are not accompanied by the nasty smell and for which the odorless nonwoven fabric for steamed towels and its manufacturing method are offered substantially.

[0004]

[Means for Solving the Problem] The nonwoven fabric for steamed towels equipped with antibacterial [ of this invention ] is characterized by the antimicrobial agent which becomes one side or both sides of a dry type nonwoven fabric or a wet nonwoven fabric from 2-(thiazolyl) benzimidazole with a particle size of 0.7-1.5 microns and 2-pyridine thiol oxide zinc salt carrying out adhesion dispersion. Moreover, after the manufacturing method of the nonwoven fabric for steamed towels equipped with antibacterial [ of this invention ] sprays uniformly the water dispersion in which the antimicrobial agent which consists of 2-(thiazolyl) benzimidazole with a particle size of 0.7-1.5 microns and 2-pyridine thiol oxide zinc salt, a surfactant, a thickener, and a binder are contained on one side or both sides of a dry type nonwoven fabric or a wet nonwoven fabric, it is characterized by drying. In this way, if humidity of the nonwoven fabric for steamed towels equipped with antibacterial [ which is manufactured ] is moderately carried out with purified water etc. after judging this in a suitable dimension and it is packed with plastic film etc., a disposable steamed towel can be obtained.

[0005]

[The mode of implementation of invention] The nonwoven fabric for steamed towels of this invention equipped with antibacterial sprays uniformly the water dispersion in which the antimicrobial agent which consists of microparticulate 2-(thiazolyl) benzimidazole (henceforth an antimicrobial

agent T) and 2-pyridine thiol oxide zinc salt (henceforth an antimicrobial agent P), a surfactant, a thickener, and a binder are contained on one side or both sides of a nonwoven fabric which are acquired from pulp fiber with dry process or a wet method, and is manufactured by drying after an appropriate time. The object with which the water suspension liquid which contains an antimicrobial agent in this invention is sprayed does not interfere, even if the binder which it does not interfere [ binder ] even if it is the nonwoven fabric obtained only with the binder manufactured with dry process or a wet method and the nonwoven fabric with which the binder for combining both pulp fiber was given when putting in another way, and combines both pulp fiber is the pulp web which is not yet given. Although a satisfactory bactericidal effect is not demonstrated if an antimicrobial agent T and an antimicrobial agent P are independent respectively, the synergistic effect excellent in antibacterial is demonstrated by using together. Phase contrast of both the antimicrobial agents used together is chosen in 10:1-1:10 by weight. As for the mean particle diameter of two kinds of antimicrobial agents used by this invention, it is desirable that it is in the range of 0.7-1.5 microns, respectively. Although based also on the amount of the binder used together as it is less than 0.7 microns, the whole front face of an antimicrobial agent will be covered with a binder, and there is disadvantage by which antibacterial effectiveness will be reduced. On the other hand, when exceeding 1.5 microns, it is difficult to distribute this over a water dispersion at homogeneity, and there is a possibility of closing homogeneity spraying to about [ that there is a fear of also causing trouble to spraying of a water dispersion ] and a nonwoven fabric if .

[0006] The binder used by this invention has the operation which makes a microparticulate antimicrobial agent adhere to a nonwoven fabric. What can use one sort, such as a styrene butadiene copolymer latex (SBR) well-known as adhesives or a binder, an acrylonitrile butadiene (NBR), natural rubber, polyvinyl acetate, ethylene and a vinyl acetate copolymer latex (EVA), polyacrylate, and a methyl methacrylate butadiene (MBR), or two sorts or more for this binder, and is excellent in a water resisting property especially is desirable. Moreover, as a surfactant, each surfactant of an anion system and the Nonion system can use it. If the example is given, dodecylbenzenesulfonic acid and its alkali-metal salt, polyoxyalkylene alkylphenol ether sulfate ammonium salt, etc. can be illustrated, for example. Moreover, xanthan gum can be mentioned as a thickener.

[0007] It faces preparing the water dispersion sprayed to a nonwoven fabric.

The water dispersion containing the approach, the microparticulate antimicrobial agent T, and antimicrobial agent P which the water dispersion containing a surfactant, a thickener, and a binder is prepared [ antimicrobial agent ] by suitable concentration, and make this distribute the microparticulate antimicrobial agent T and an antimicrobial agent P, How to mix the water dispersion containing a surfactant, a thickener, and a binder, the approach and water which make the water dispersion containing the microparticulate antimicrobial agent T and an antimicrobial agent P distribute a surfactant, a thickener, and a binder -- a surfactant, a binder, a thickener, and two kinds of microparticulate antimicrobial agents -- order -- or the approach which adds to coincidence and it is made to distribute can be chosen as arbitration. which the above-mentioned approach -- spraying -- service water -- although the solid content concentration is suitably adjusted so that it may be suitable for spraying even when preparing dispersion liquid, it is desirable to consider as 1 - 15% of the weight of within the limits generally. As for the amount of the binder in dispersion liquid, it is desirable to choose in the 40 to 200 times as much range as antimicrobial agent sum total weight. If fewer than 40 times, in case it will be used as a steamed towel, an antimicrobial agent worsens dedropping and a feeling of use from a nonwoven fabric. Moreover, if 200 times are exceeded, a binder will cover an antimicrobial agent front face too much, and the result which weakens antibacterial effectiveness will be caused. According to spraying of a water dispersion, the amount of the antimicrobial agent made to adhere to a nonwoven fabric sets an antimicrobial agent P and an antimicrobial agent T, and is chosen in 0.05-0.3g/m<sup>2</sup> in the double-sided sum total of a nonwoven fabric. Stoving of the nonwoven fabric after spraying a water dispersion is carried out preferably. The moisture in spray liquid evaporates in this process, and two sorts of microparticulate antimicrobial agents fix on a nonwoven fabric front face with a binder. In this way, the nonwoven fabric for steamed towels equipped with antibacterial [ which was acquired ] is processible into a disposable steamed towel by judging this in a suitable dimension and packing each piece of decision with plastic film etc. [0008]

[Example] The example of this invention is shown below.

Example 1 basis weight dried for 10 minutes at 140 degrees C, after spraying the water dispersion containing 0.00165 % of the weight of sodium dodecylbenzenesulfonate, 0.000066 % of the weight of KISAN out gums, and 3.3 % of the weight of styrene butadiene polymer latexes on one side of the pulp web cut in the 400mm long and 250mm wide dimension by 50 g/m<sup>2</sup> by



the hand spray at homogeneity antimicrobial agent T(0.9-1.2 microns) 0.00825 % of the weight and antimicrobial agent P(0.9-1.2 microns) 0.00825% of the weight. The same processing also as the opposite side of a pulp web was performed, and the antibacterial nonwoven fabric was obtained. The coating weight of an antimicrobial agent was adjusted so that it might become 0.05 g/m<sup>2</sup> in the double-sided sum total.

Example 2 basis weight dried for 10 minutes at 140 degrees C, after spraying the water dispersion containing 0.00165 % of the weight of sodium dodecylbenzenesulfonate, 0.000066 % of the weight of KISAN out gums, and 3.3 % of the weight of styrene butadiene polymer latexes on one side of the pulp web cut in the 400mm long and 250mm wide dimension by 50 g/m<sup>2</sup> by the hand spray at homogeneity antimicrobial agent T(1.0-1.4 microns) 0.00825 % of the weight and antimicrobial agent P(1.0-1.4 microns) 0.00825% of the weight. The same processing also as the opposite side of a pulp web was performed, and the antibacterial nonwoven fabric was obtained. The coating weight of an antimicrobial agent was adjusted so that it might become 0.05 g/m<sup>2</sup> in the double-sided sum total.

Example 3 basis weight dried for 10 minutes at 140 degrees C, after spraying the water dispersion containing 0.00165 % of the weight of sodium dodecylbenzenesulfonate, 0.000066 % of the weight of KISAN out gums, and 3.3 % of the weight of styrene butadiene polymer latexes on one side of the pulp web cut in the 400mm long and 250mm wide dimension by 50 g/m<sup>2</sup> by the hand spray at homogeneity antimicrobial agent T(0.9-1.2 microns) 0.004125 % of the weight and antimicrobial agent P(0.9-1.2 microns) 0.012375% of the weight. The same processing also as the opposite side of a pulp web was performed, and the antibacterial nonwoven fabric was obtained. The coating weight of an antimicrobial agent was adjusted so that it might become 0.05 g/m<sup>2</sup> in the double-sided sum total.

The antibacterial nonwoven fabric was obtained like the example 1 except having changed into the antimicrobial agent T (2.0-5.0 microns) and the antimicrobial agent P (2.0-5.0 microns) the particle size of the antimicrobial agent used in example of comparison 1 example 1.

By 50 g/m<sup>2</sup>, example of comparison 2 basis weight on one side of the pulp web in a 400mm long and 250mm wide dimension Antimicrobial agent T(0.9-1.2 microns) 15 % of the weight, antimicrobial agent P(0.9-1.2 microns) 5 % of the weight, 1.5 % of the weight of polyoxyethylene styryl ether, 1 % of the weight of dioctyl sulfosuccinate, The suspension which consists of 4 % of the weight of White KABUN, 0.15 % of the weight of KIKASAN tungums, and

73.35 % of the weight of water was diluted with water, and after spraying on homogeneity by the hand spray, it dried for 10 minutes at 140 degrees C. The same processing also as the opposite side of a nonwoven fabric was performed, and the antibacterial nonwoven fabric was obtained. The coating weight of an antimicrobial agent was adjusted so that it might become 0.05 g/m<sup>2</sup> in the double-sided sum total.

It replaced with two kinds of antimicrobial agents used in the example of comparison 3 example 1, and the antibacterial nonwoven fabric was both obtained like the example 1 except [ which uses an antimicrobial agent T, an antimicrobial agent P, and p-chloro METAKISHI Norian (CMX) independently, respectively ] having made concentration in a water dispersion into 0.165 % of the weight, 0.165 % of the weight, and 0.0132 % of the weight, respectively.

It replaced with two kinds of antimicrobial agents used in the example of comparison 4 example 1, the benzalkonium chloride (CBe) was used, and the antibacterial nonwoven fabric was obtained like the example 1 except having made the concentration in a water dispersion into 0.12375 % of the weight. By 50g/m<sup>2</sup>, after spraying the benzalkonium chloride (CBe) water solution of 0.5 % of the weight of concentration on one side of the nonwoven fabric which gave only the binder with a 400mm long and 250mm wide dimension, example of comparison 5 basis weight dried this, and obtained the antibacterial nonwoven fabric.

By 50 g/m<sup>2</sup>, after spraying a stabilization chlorine dioxide (ClO<sub>2</sub>) water solution with a concentration of 500 ppm on one side of the nonwoven fabric which gave only the binder with a 400mm long and 250mm wide dimension, example of comparison 6 basis weight dried this, and obtained the antibacterial nonwoven fabric.

[0009] The example 1 of a trial: The antibacterial nonwoven fabric obtained in the anti-mold trial example and the example of a comparison was cut out in 50mmx50mm magnitude, the purified water which corresponds by 2.5 times the weight was infiltrated, and it considered as the humid sheet, and it placed so that this might be inoculated in the center of the culture side of the plate agar included in the Petri dish of 90mm of diameters. After sprinkling one cc of mixed spore suspension equally to a culture side and the field of the above-mentioned sheet, it covered, maintained at the temperature of 28\*2 degrees C, and cultivated for four weeks. The culture medium used for the trial consists of 1000 cc [ of purified water ], 3.0g [ of ammonium nitrates ], and phosphoric-acid 1 potassium 1.0g, 0.5g of magnesium sulfate, 0.25g of

potassium chloride, 0.002g of ferrous sulfates, and 25g of agars. Moreover, mixed spore suspension consists of a bacillus of *Aspergillus NIGERU*, *Penicillium citrinum*, keto MIUMU grotesque BOSUMU, and GURIOKU Radim BIRENSU. A test result is a naked eye, observed the growth condition of the hypha produced on the front face of a sample sheet at the 4th week of the culture, and the 8th week, and judged effectiveness by the following criteria. A result is shown in Table 1.

Score Criterion 4 Growth of a hypha is not accepted in the part which inoculated the sample sheet.

3 The area of the growth part of the hypha accepted in the part which inoculated the sample sheet does not exceed one fifth of whole surface products.

2 The area of the growth part of the hypha accepted in the part which inoculated the sample sheet does not exceed one third of whole surface products.

1 The area of the growth part of the hypha accepted in the part which inoculated the sample sheet exceeds one third of whole surface products.

The example 2 of a trial: The fungus liquid (106 bacillus concentration/cc) which corresponds by 2.5 times the weight was infiltrated into the antibacterial nonwoven fabric obtained in the anti-microbiological examination example and the example of a comparison, it considered as the humid sheet, and this was put in and sealed to vinyl bag manufacture. after leaving it at 35-37 degrees C for 24 hours, in addition, sterilized water is rubbed to increase 10 times, a bacillus is extracted, and . result of having measured the number of microorganism which survives with an agar plate process is shown in Table 1. A *Staphylococcus aureus*, *Pseudomonas ERUGINOSA*, and *Escherichia coli* were used for sample offering fungus liquid. The surviving number of microorganism performed evaluation on the following criteria.

Score Four survivors Less than [ 102 piece ] 3 Less than [ 102-104 piece ] 2 Less than [ 104-106 piece ] 1 106 or more pieces [0010]

[Table 1]

	抗菌剤	付着量 (g / m <sup>2</sup> )	抗微性		抗細菌性
			4週間目	8週間目	
実施例 1	T P	0.025 0.025	4	4	4
実施例 2	T P	0.025 0.025	4	4	4
実施例 3	T P	0.0125 0.0375	4	4	4
比較例 1	T P	0.025 0.025	3	2	3
比較例 2	T P	0.0375 0.0125	3	2	3
比較例 3 a	T	0.05	2	2	2
比較例 3 b	P	0.05	2	2	2
比較例 3 c	CMX	0.04	1	1	1
比較例 4	CBe	0.75	2	2	2
比較例 5	CBe	0.75	2	2	2
比較例 6	ClO <sub>2</sub>	0.075	2	2	2

[0011] The example 3 of a trial: After skin-irritation-study skin irritation study infiltrated the purified water which corresponds by 2.5 times the weight, and it used it as the humid sheet and it stuck this on the antibacterial nonwoven fabric obtained in the example and the example of a comparison for 24 hours at the human overarm section inside section, it exfoliated, and it carried out the macro-scopic judging of the overarm inside section 30 minutes after exfoliation on the following criteria. A result is shown in Table 2.

Evaluation Criterion O With no change on the skin of a pasting part.

Redness is accepted a little in the skin of a \*\* pasting part.

x A swelling is accepted in the skin of a pasting part.

Example 4 of a trial: Odor nature, the feeling trial odor nature of use, and the feeling trial of use infiltrated the purified water which corresponds by 2.5 times the weight into the antibacterial nonwoven fabric obtained in the example and the example of a comparison, and were used as the humid sheet, this was completely sealed with the odorless polypropylene film, respectively, ten persons' equipment monitor test was performed after one week, and the following criterion estimated an odor and a feeling of use. A result is shown in Table 2.

Odor nature evaluation Criterion O It stinks no odor or slightly.

\*\* -- it stinks clearly.

x It stinks strongly.

feeling evaluation of use Criterion O fitness \*\* -- there is a feeling of slime a little.

x There is a feeling of slime.

[0012]

[Table 2]

	皮膚刺激性	臭気	使用感
実施例 1	○	○	○
実施例 2	○	○	○
実施例 3	○	○	○
比較例 1	△	○	○
比較例 2	○	○	×
比較例 3 a	○	○	○
比較例 3 b	○	○	○
比較例 3 c	○	×	○
比較例 4	×	○	×
比較例 5	△	○	△
比較例 6	○	△	○

[0013] Except having made the amount of the binder contained in the water dispersion used in the example of trial 4 example 1 fluctuate, and having changed the weight ratio of a binder to an antimicrobial agent, the antibacterial nonwoven fabric was prepared like the example 1, and the approach which described above antifungal [ each ] (the 4th week), antibacterial one, skin irritation, and a feeling of use estimated. A result is shown in Table 3.

[0014]

[Table 3]

抗菌剤/固着剤 重量比	防黴性	抗細菌性	皮膚刺激性	使用感
1/400	1	1	○	○
1/267	3	2	○	○
1/200	4	4	○	○
1/100	4	4	○	○
1/50	4	4	○	○
1/40	4	4	○	○
1/33	3	3	△	×

[0015] As for antibacterial effectiveness, what used together the antimicrobial agent T and the antimicrobial agent P is the highest, and in being an antimicrobial agent T independent and antimicrobial agent P independent, antibacterial effectiveness is inferior so that clearly from Table 1 and 2. Moreover, when p-chloro METAKISHI Norian is used, it is not suitable as a steamed towel with about [ that antibacterial effectiveness becomes still poorer ] and an unpleasant smell. Although use of a benzalkonium chloride shows temporary antibacterial effectiveness, it cannot give antibacterial [ uniform ]. Although chlorine-based drugs demonstrate antibacterial [ temporary ] by the occurring gas, when maintaining the effectiveness for a

long period of time expects the difficult antibacterial effectiveness of . long period of time and it increases the amount of the antimicrobial agent used, they have a fear of an unpleasant smell becoming strong. What has a large particle size is inferior in antibacterial, probably because spraying to a nonwoven fabric does not become equal. Moreover, if a binder is not used, the dispersibility of an antimicrobial agent particle will be bad and it will result in it being inferior in antibacterial. Moreover, since omission from the fiber of an antimicrobial agent take place that the amount of the binder used to an antimicrobial agent is less than [ 40 weight twice ] to the omission list of fiber so that clearly from the result shown in Table 3, antibacterial effectiveness decreases and skin irritation also gets worse a little. moreover -- if 200 weight twice are exceeded -- an antimicrobial agent -- spraying -- service water -- probably because it will be covered with the solid content which lives together in dispersion liquid too much, a mildew resistant effect and the \*\*\*\*\* effectiveness fall.

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[Translation done.]